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Influence of Passive Smoking on Basic Anthropometric Characteristics and Respiratory Function in Young Athletes

Ivana Goić-Barišić[1], Anteo Bradarić[2], Marko Erceg[3], Igor Barišić[4], Nikola Foretić[3], Neven Pavlov[5] and Jadranka Tocilj[2]

[1] Department of Clinical Microbiology, University Hospital »Split«, Split, Croatia
[2] Department of Pulmology, University Hospital »Split«, Split, Croatia
[3] Department of Kinesiology, Faculty of Natural Sciences Mathematics and Kinesiology, University of Split, »Split«, Croatia
[4] Department of Diagnostic and Interventional Radiology, University Hospital »Split«, Split, Croatia
[5] Pediatric Clinic, University Hospital »Split«, Split, Croatia

A B S T R A C T

The primary objective of this study is to investigate the maintenance difference in basic anthropometric characteristics and to outline the dynamics of respiratory function change in youngsters athletes exposed to passive smoking (PS) and athletes not exposed to passive smoking in their families (NPS). High and weight were determined as basis anthropometric characteristics. Measured parameters for respiratory function were vital capacity (VC), forced expiratory volume in the first second (FEV1), maximum expiratory flow (PEF), forced expiratory flow at 50% forced vital capacity (MEF 50) and forced expiratory flow at 25% forced vital capacity (MEF 25). Significant statistical differences in separate spirometric variable were found in three variables (FEV1, MEF50, and MEF25) for group older youngsters. Analysis of variance showed statistical differences between athletes unexposed to passive smoking (NPS) and athletes exposed to passive smoking (PS) in even four spirometric variables (VC, FEV1, MEF50 and MEF25).

Key words: *passive smoking, respiratory function, athletes*

Introduction

Smoking is a major public health issue due to its direct and indirect effects on health outcomes[1–3]. Previous studies have suggested that passive smoking (involuntary inhalation of tobacco smoke by nonsmokers) reduces small airways function[1,3]. Passive smoking may affect children directly, by decreasing pulmonary function, or indirectly [4,5] by increasing their exposure to infectious diseases, since smokers have a higher incidence of respiratory infections[1–3]. Maternal smoking during pregnancy is a major risk factor for preterm delivery, low birth weight, intrauterine growth retardation, and intrauterine death[6].

According to World Health Organization (WHO), almost half of the world children are exposed to tobacco smoke of adult smokers. WHO states that passive smoking is thru cause of bronchitis, pneumonia, coughing and troubled breathing, and fits of asthma, middle ear infections, and cardiovascular damages in children and adults[7–9].

Previous studies in this field have mostly been based on the follow-up of forced expiratory volume in the first second (FEV 1) and forced expiratory flow at 25–75% FCV (MEF 25–75)[10,11]. Respiratory function tests provide objective, quantitative data on the functioning of the respiratory system. They are used for both diagnostic and prognostic purposes and can also be used as a method of diagnosis and prognosis of functional abilities of young athletes.

We evaluated the exposure to passive smoking and its effects on pulmonary function in five spirometric indicators and two anthropometric parameters in a group of 8 to 15 year-old youngster's athletes.

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Materials and Methods

Study design and patients

Basic anthropometric characteristics and respiratory functional indicators have been measured on 100 youngster's athletes (swimmers, handball players, and soccer players) with mean age of the test subjects 12.98 year (8–15 years old). As basics anthropometric characteristics high and weight were determined. The examiners train on average 1.5–4 hours, 4–5 times a week. All of the subjects have been training from the age of six. All of the subjects included in the study have been training constantly for at least the past 6 months.

None of the examiners is an active smoker. The group of subjects exposed to passive smoking (PS) consisted of those examinees whose one or both parents smoke at least 10 cigarettes in family surrounding, and time of exposure to passive smoking amounted to at least 2 hours a day. They have been exposed to passive smoking for at least five years, almost on a daily basis. The number of people smoking in their surrounding has been limited to two, generally their parents. The exposure to passive smoking in age 8 to15 years is possible almost in family surrounding, because they have very little free time outside the family home.

Six subjects have been excluded from the study. One of them has been excluded because of training pause longer than month. One test subject has been excluded because of several years' history of asthma. Two subjects have not been included due to virosis during the course of the study and still two because their exposure to smoking was lower than the prescribed criteria. None of the subjects included in the study has been diagnosed with acute or chronic diseases. Both the parents and the leaders of the soccer, handball and swimming teams have given written consent to the participation of test subjects in the study. The parents also have given data about exposure to passive smoking their children.

The examiners were divided into two groups according the age. In fist group (Group A) were 24 athletes from 8 to 11 years old with mean age 10.13 year (12 PS and 12 non passive smokers – NPS). In the second group (Group B) were 70 youngsters from 12 to 15 years old with mean age 13.80 year (31 PS and 39 NPS).

Sample of variables

As basis anthropometric characteristics, high and weight were determined according International biological programme (IBP) recommendation. Respiratory functional indicators have been measured in resting by means of the pulmonary function measuring device »Master Lab« produced by Jaeger. The pulmonary function measuring device is completely automatic. It consists of three functional units: »Master Lab Pneumo«, »Master Lab Transfer« and »Master Lab Body«, which runs on a computer system. The computer is running CAP (Computer Aided Pulmonary Diagnostic software) consisting of programs for examinations pulmonary function: spirometry flow-volume curve**,** diffusion by means of the techniques of one inhalation and body pletismography. The programs contain all technical criteria, technical indicators and reference values in Civil Engineering Contractors Association (CECA) and American Thoracic Society (ATS) standards. Spirometry is the method for measuring the volume of air in the lungs during breathing. Before the measurement itself, the spirometer is gauged several times and 2 l of air is introduced into it, while the computer monitor records the air inspired/expired flow-volume plot. In spirometric measurements, the examinee, using a mouth piece, first exhales maximally from normal breathing regime, and then inhales maximally. The computer program uses the data on the age, height and mass of the examinee to determine the values of parameters expected according to standard defined, and also report their actual values. The difference between the values expected and actual is expressed in percentages. The following parameters have been measured: lung vital capacity (VC), forced expiratory volume in the first second (FEV1), maximum expiratory flow (PEF), forced expiratory flow at 50% forced vital capacity (MEF50), forced expiratory flow at 25% forced vital capacity (MEF25), height (H), and weight (W). Ventilatory measurement results were expressed automatically as percentage of referent values (ESC norms), depending of age, sex, high and weight.

Data processing methods

By using the software package »STATISTICA«, i.e. the program Statistic for »Windows Ver5.5«, basic statistical parameters have been obtained. All differences in which the probability of the null hypothesis was $p<0.05$ were considered statistically significant. In line with objective of the study, the multivariate analysis of variance has been performed in order to determine the relevance of differences between the obtained statuses of all tests simultaneously. Univariate analysis of variance has been performed to determine differences at each variable between groups of examinees.

Results

From 100 youngsters, 6 subjects (6%) have not been included in the study because they have not fitted in testing criteria. Between 94 youngster's athletes were 52 swimmers, 30 handball players and 12 soccer players. Basic anthropometrics characteristic were showed in Table 1. Data are pointing that athletes in group A unexposed to passive smoking (NPS) are higher 0.84 (0.56%) cm and heavier about 2.17 kg (5.62%) than athletes exposed to passive smoking (PS). The youngsters unexposed to passive smoking (NPS) from the group B were higher 1.62 cm (0.93%) and heavier 0.8 kg (1.35%) from exposed athletes (PS). Altogether, data are pointing that athletes unexposed to passive smoking (NPS) are higher 2.44 cm (1.45%) and heavier 2.09 kg (4.88%) than athletes exposed to passive smoking (PS). Multivariate analysis of variance (Table 2) for anthropometric characteristics and age showed that statistical differences between

TABLE 1
CHARACTERISTICS OF CURRENTLY EXPOSED AND UNEXPOSED ATHLETES

	Group A		Group B		Total	
Variable	PS (N=12)	NPS (N=12)	PS (N=31)	NPS (N=39)	PS (N=43)	NPS (N=51)
Age	10.00 (0.6)	10.25 (0.97)	13.77 (1.12)	13.82 (1.14)	12.72 (1.98)	12.98 (1.88)
Height (cm)	148.83 (9.23)	149.67 (8.80)	171.84 (9.78)	173.46 (8.13)	165.42 (14.13)	167.86 (13.08)
Weight (kg)	36.50 (4.62)	38.67 (5.73)	58.61 (10.69)	59.41 (10.25)	52.44 (13.71)	54.53 (12.88)

Data are mean % (SD %), Group A – 8–11 years, Group B – 12–15 years, PS – passive smokers, NPS – non passive smokers

TABLE 2
MANOVA BETWEEN EXPOSED AND UNEXPOSED ATHLETES FOR ANTHROPOMETRIC VARIABLES

	Wilks' λ	Rao R	p
Group A	0.91	0.68	0.57
Group B	0.99	0.27	0.85
Total	0.99	0.25	0.86

MANOVA – Multivariate Analysis of Variance, Wilks´ λ, Rao R – multivarijate measure of group differences over several variables, p – significance level of the difference between two groups

athletes unexposed to passive smoking (NPS) and athletes exposed to passive smoking (PS) in high and weight were not statistically significant ($p>0.05$). That means that the differences between arithmetic means of NPS and PS athletes are not statistically significant in applied system of variables for these two groups of athletes.

Multivariate analysis of variance for spirometric variables is showed in Table 4. Wilks' Lambda and Rao R (which tests value of lambda) are statistically significant for group B and altogether athletes. That means statistically significant differences between arithmetic means of NPS and PS athletes in these two groups in applied system of variables.

TABLE 4
MANOVA BETWEEN EXPOSED AND UNEXPOSED ATHLETES FOR SPYROMETRIC VARIABLES

	Wilks' λ	Rao R	p
Group A	0.68	1.71	0.18
Group B	0.82	2.80	0.02
Total	0.85	3.14	0.01

MANOVA – Multivariate Analysis of Variance, Wilks´ λ, Rao R – multivariate measure of group differences over several variables, p – significance level of the difference between two groups

Differences at each observed spirometric variable between unexposed (NPS) and exposed (PS) athletes to passive smoking are presented in Table 3.

Results analyses (ANOVA-Table 3) clearly show significant statistical differences in whole system of spirometric variables between NPS and PS athletes for group B and altogether athletes. Significant statistical differences ($p<0.05$) in separate spirometric variable (ANOVA – Table 3) were found in three variables (FEV1, MEF50, and MEF25) for group B. Altogether athletes exposed to passive smoking (PS) have significant statistical differences in four variables (VC, FEV1, MEF 50, and MEF 25) in opposite of youngsters unexposed to passive smoking (NPS).

Discussion

The data we have obtained confirm some results of the previous studies based on influence exposure to passive smoking young athletes[11,12]. The results noted nega-

TABLE 3
ANOVA BETWEEN EXPOSED AND UNEXPOSED ATHLETES FOR SPYROMETRIC VARIABLES

	Group A		Group B		Total	
Variable	PS (N=12)	NPS (N=12)	PS (N=31)	NPS (N=39)	PS (N=43)	NPS (N=51)
VC	98.28 (10.56)	104.28 (18.00)	93.95 (11.50)	99.46 (13.33)	94.48 (12.34)	100.15 (14.25)*
FEV 1	111.20 (9.50)	119.72 (17.89)	102.52 (8.61)	111.86 (13.29)**	104.94 (9.59)	113.71 (14.63)**
PEF	97.85 (9.50)	93.53 (20.21)	101.19 (13.37)	107.27 (20.31)	100.26 (12.39)	104.04 (20.93)
MEF50	104.88 (8.04)	117.94 (24.76)	101.01 (18.09)	115.28 (22.81)**	102.07 (15.93)	115.91 (23.05)**
MEF25	110.65 (7.46)	130.45 (37.28)	113.48 (31.38)	128.23 (33.27)*	112.63 (26.83)	128.75 (33.88)*

Data are mean % (SD %), ANOVA – Analysis of Variance, *$p<0.05$, **$p<0.01$, PS – passive smokers, NPS – non passive smokers, VC – vital capacity, FEV 1 – forced expiratory volume in first second, PEF – maximum expiratory flow, MEF 50 – forced expiratory flow at 50% forced vital capacity, MEF 25 – forced expiratory flow at 25% forced vital capacity tive influence of passive smoking to respiratory function and anthropometric characteristics included in the study. Although no statistically relevant differences in height and weight have been found, considerable differences in high and weight are evident. NPS athletes are on average higher (2.44 cm) and heavier (2.09 kg) than PS athletes, which are in correlation with French study[12] who explored influence of smoking, at young athletes, on increasing body weight and proven statistically significant less body weight in PS athletes.

Unexposed athletes (NPS) have at average higher results in all observed static and dynamic respiratory parameters in respect to exposed athletes (PS). Previous studies explored static or dynamic parameters separately. Even 4 from 5 spirometric parameters showed statistically significant difference between athletes exposed and unexposed to passive smoking: VC, FEV1, MEF50 and MEF25 (Table 3). Unexposed athletes have average higher results in MEF25 for 16.12%, MEF50 for 13.84%, FEV1 for 8.77%, and VC for 5.67% in respect to passive smoking athletes. Significant statistical differences in separate spirometric variable in three variables (FEV1, MEF50, and MEF25) for group older youngsters (group B) could be consequence of longer exposure to passive smoking in relation to younger group (group A).

The difference in vital capacity (VC) is significant on level $p<0.05$ which emphasize negative effects of passive smoking not only on dynamic but also on static pulmonary capacities. In variables, which represent dynamic in small airways, the levels of significant are $p<0.01$ (MEF50) and $p<0.05$ (MEF25). Negative impact of passive smoking on small airways is obviously inflammatory reaction caused by irritants in cigarettes and decrease in speed current of air in lungs as a result of enhanced resistance. Our results acknowledge published investigations where authors have found a four times higher increase of reduced FEF25–75 (these parameters appropriate the values of MEF 25–75 and depend of manufacturer terminology) and/or the occurrence of coughing in sport players exposed to passive smoking in respect to sport players who have not been exposed[11].

In variable forced expiratory volume in the first second (FEV1) the difference is significant on level $p<0.01$ which statements conclusion that passive smokers athletes have developed great disorders of ventilation obstructive type.

All harvested data indicate the conclusion of negative influence of passive smoking on, in this investigation measured, anthropometric and spirometric variables. The results of our investigation indicate effects of passive smoking on growth and development young athletes and their pulmonary function as well as cause bad performances and insufficiently physical condition young athletes. It is considerably observation that NPS athletes are better in all measured ventilatory parameters then PS athletes.

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I. Goić-Barišić

Department of Clinical Microbiology, University Hospital »Split«, Spinčićeva 1, 21000 Split, Croatia
e-mail: ivanagoicbar@net.hr

UTJECAJ PASIVNOG PUŠENJA NA OSNOVNE ANTROPOMETRIJSKE KARAKTERISTIKE I RESPIRACIJSKU FUNKCIJU MLADIH SPORTAŠA

SAŽETAK

Cilj studije je istražiti postojanje razlike u osnovnim antropometrijskim parametrima i promjene u respiracijskim funkcijama kod mladih sportaša izloženih pasivnom pušenju (PS) unutar obitelji u odnosu na mlade sportaše koji nisu izloženi pasivnom pušenju (NPS) unutar obitelji. Kao osnovni antropometrijski parametri mjereni su visina i težina mladih sportaša. Respiracijska funkcija je istražena mjerenjem vitalnog kapaciteta (VC), forsiranim respiracijskim volumenom u prvoj sekundi (FEV1), vršnim ekspiracijskim protokom (PEF), forsiranim ekspiracijskim protokom pri 50%

forsiranog vitalnog kapaciteta (MEF 50) te forsiranim ekspiracijskim protokom pri 25% forsiranog vitalnog kapaciteta (MEF 25). Statističkom obradom rezultata uočena je značajna razlika u pojedinačnim varijablama kod grupe sportaša u dobi 12–15 godina (grupa B) izloženih pasivnom pušenju u tri varijable (FEV1, MEF50 i MEF25) u odnosu na mlade sportaše koji nisu izloženi pasivnom pušenju u dobi 8–11 godina (grupa A). Analiza svih respiracijskih parametara u grupi sportaša izloženih pasivnom pušenju (PS) pokazala je statistički značajne razlike u čak četiri varijable (VC, FEV1, MEF50 i MEF25) u odnosu na grupu sportaša neizloženu pasivnom pušenju.